Wing of aircraft

Subject matter of an invention is wing of aircraft with slats and segmented one-slotted sliding flaps with driving gear.

There are known wings of aircraft with slats and slotted sliding flaps of Fowler type composed as one segment. After flaps extending, in place of their original position there remain open chambers from underneath of wing. It generates unfavourable increase of flow drag at the bottom of wing airfoil.

Driving gear of flaps in known solutions is located crosswise of wing span and protrudes beyond transversal outline of wing, where it is shielded by under-wing fairings.

Wing of aircraft with slats and flaps according to the invention is characterized by two movable segments in each flap: fore box and main flap, which are connected by spring actuators to each other and move on rolls along guides of radius bigger than a half chord of wing airfoil section. The flap segments are located in chamber composing a sector of cylinder wall with thickness limited by both upper flow-surface of wing box and closing panel situated at the bottom of this box. Fore box of flap is situated in each of its position at least partially within the chamber, whereas main flap is situated in its various positions at least partially within the chamber or fully beyond it.

Driving gear of each flap is located along wing span and completely hidden in transversal outline of the wing.

A solution according to the invention brings profitable effects, increasing wing lift throughout three phases of flight – take-off, cruising and landing of aircraft. At cruising phase, in range of small angles of flap displacement, it affords possibilities for un-slotted increase of wing airfoil camber. At both take-off and landing phases an increase of flap displacement with simultaneous extension of wing airfoil allows to obtain optimal airfoil with slotted flow in these conditions, preventing premature flow separation on upper wall of an airfoil. For each phase of flight, also owing to panel closing chamber, there is decreased flow drag on bottom wall of an airfoil.

A location of driving gear of each wing flap along wing span so, that it is completely hidden in transversal outline of the wing, allows either to eliminate, or significant dimension reduction of under-wing fairings shielding driving gear in traditional solutions. It leads to a decrease of wing drag, and as a consequence whole aircraft, of about 1.5 %.

A wing of aircraft may be equipped, along span of trailing edge with greater number of flaps (e.g. over a dozen). It allows to obtain following utility characteristics of wing:

- high coefficient of lift,
- optimal distribution of both circulation and lift along span, according to flight phase, due to an analysis of both induced drag and weight of structure,
- elimination of conventional lateral control in form of ailerons or flaperons.

The object of the invention is shown as exemplary embodiment in drawing, in which fig.1 presents wing airfoil section according to the invention, with indication of both guides radius and airfoil chord, and following figures present the same airfoil section: fig.2 – in cruising phase for smooth configuration, fig.3 – in cruising phase for increased camber configuration, fig.4 – in take-off phase, fig.5 – in landing phase, while fig.6 presents segment of wing, according to the invention, with built in driving gear, at top view, in cruising phase, fig.7 – cross section of this segment, fig.8 – the same

segment at top view, in landing phase. fig.9 – cross section of this segment, fig.10 presents driving gear of flap with its main components, at top half-view, fig.11 – section of this gear marked as A-A on fig.10. and fig.12 – section of this gear marked as B-B on fig.10.

Wing of aircraft is equipped with slats 1 and segmented sliding flaps. Two movable segments in each flap: fore box 2 and main flap 3. are connected by spring actuators 4 to each other. The segments move on rolls 5 along guides 6 of radius R bigger than a half chord c of wing airfoil section. They are located in chamber 7, which composes a sector of cylinder wall with thickness limited by both upper flow-surface of wing box 8 and closing panel 9 situated at the bottom of this box.

The driving gear of each flap is located along wing span and completely hidden in transversal outline of the wing. It is fixed on rear plane 10 of wing box 8, perpendicular to airfoil section chord c.

Main flap 3 is moved forward by pusher 11. connected on one end with flap ferrule 12, and on other one with trolley 13 sliding along guide 14 on screw 15 powered by Cardan joint 16. by hydraulic engine 17 with transmission gear 18. A motion of fore box 2 results from its connection with main flap 3 by spring actuators 4.

During an aircraft cruising phase. the driving gear of flaps gives possibility to move main flap 3 forward so the wing airfoil both cambers slightly and elongates a little; at the same time fore box 2 is totally situated within chamber 7, and the main flap remains at partial contact with the chamber. During aircraft take-off and landing phases the driving gear of flaps generates protrusion of main flap 3 fully beyond chamber 7; at the same time fore box 2 partially contacts with the box. In effect it gives elongated wing airfoil with one slot flow only.